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(54) Electronic music pace and distance counting shoe

(57) This invention relates to an apparatus for providing an additional electronic circuit device in a shoe which, upon walking, jogging or running, applies the technique of utilizing a single chip microcomputer, means for counting the number of steps, measuring the approximate distance and counting the time people have walked or run. It also provides the walking speed rate, music beat and beat sound; etc.

GB 2 121 219 A

2121219

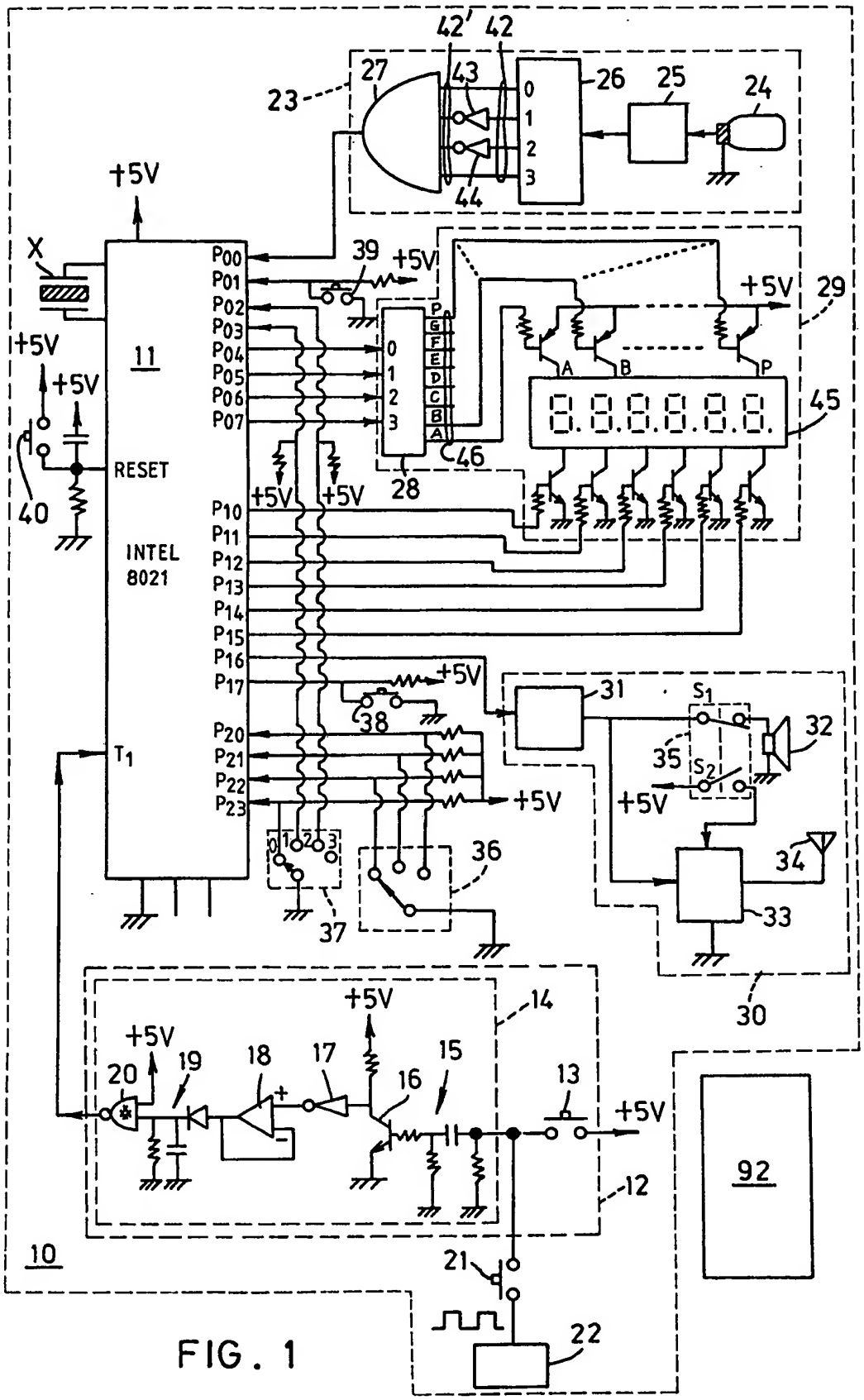

FIG. 1

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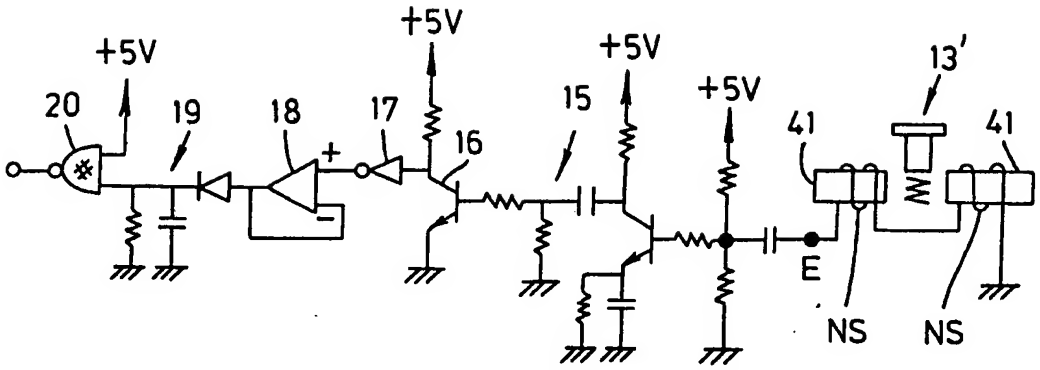

FIG. 2

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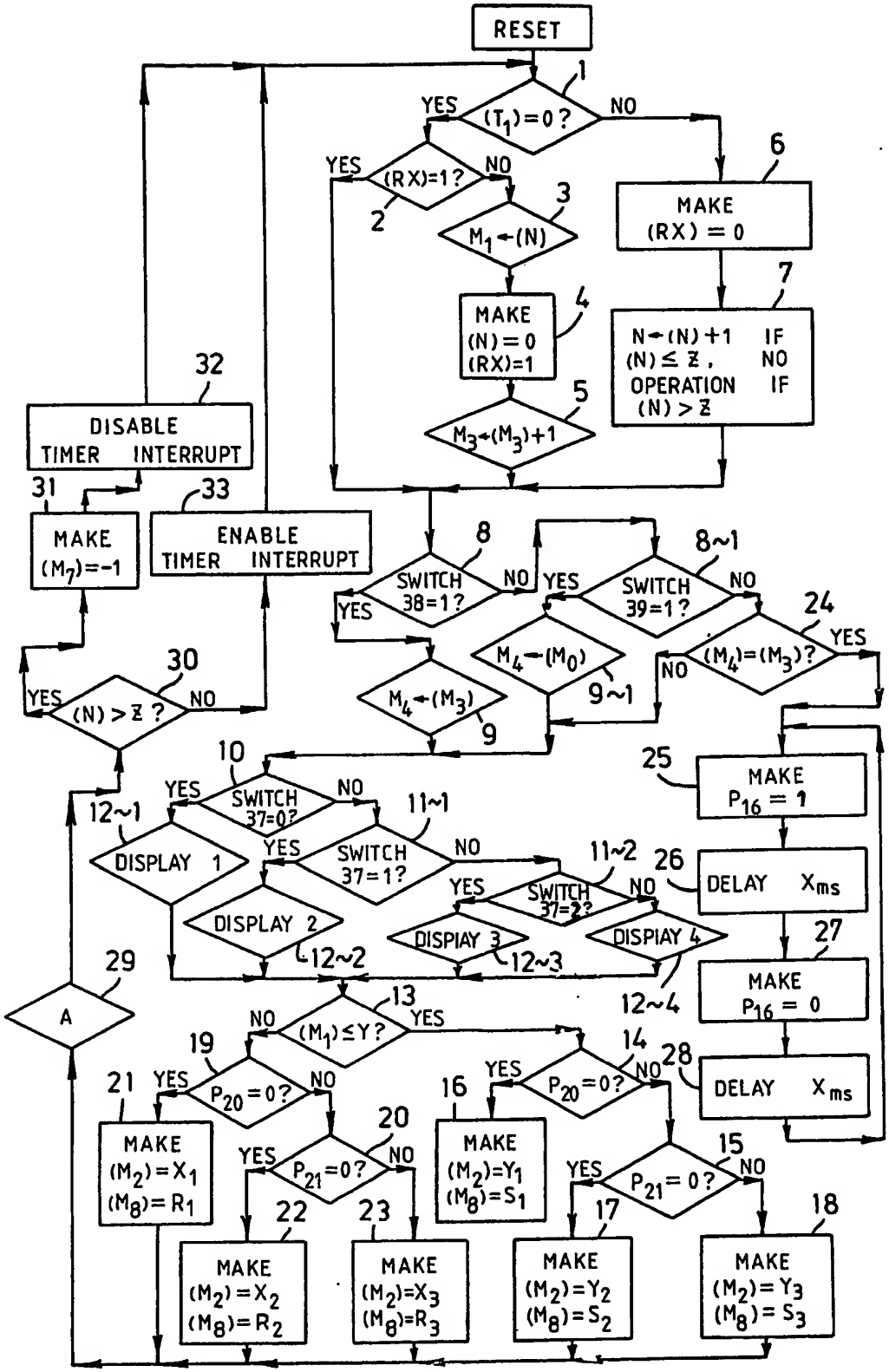

FIG. 3

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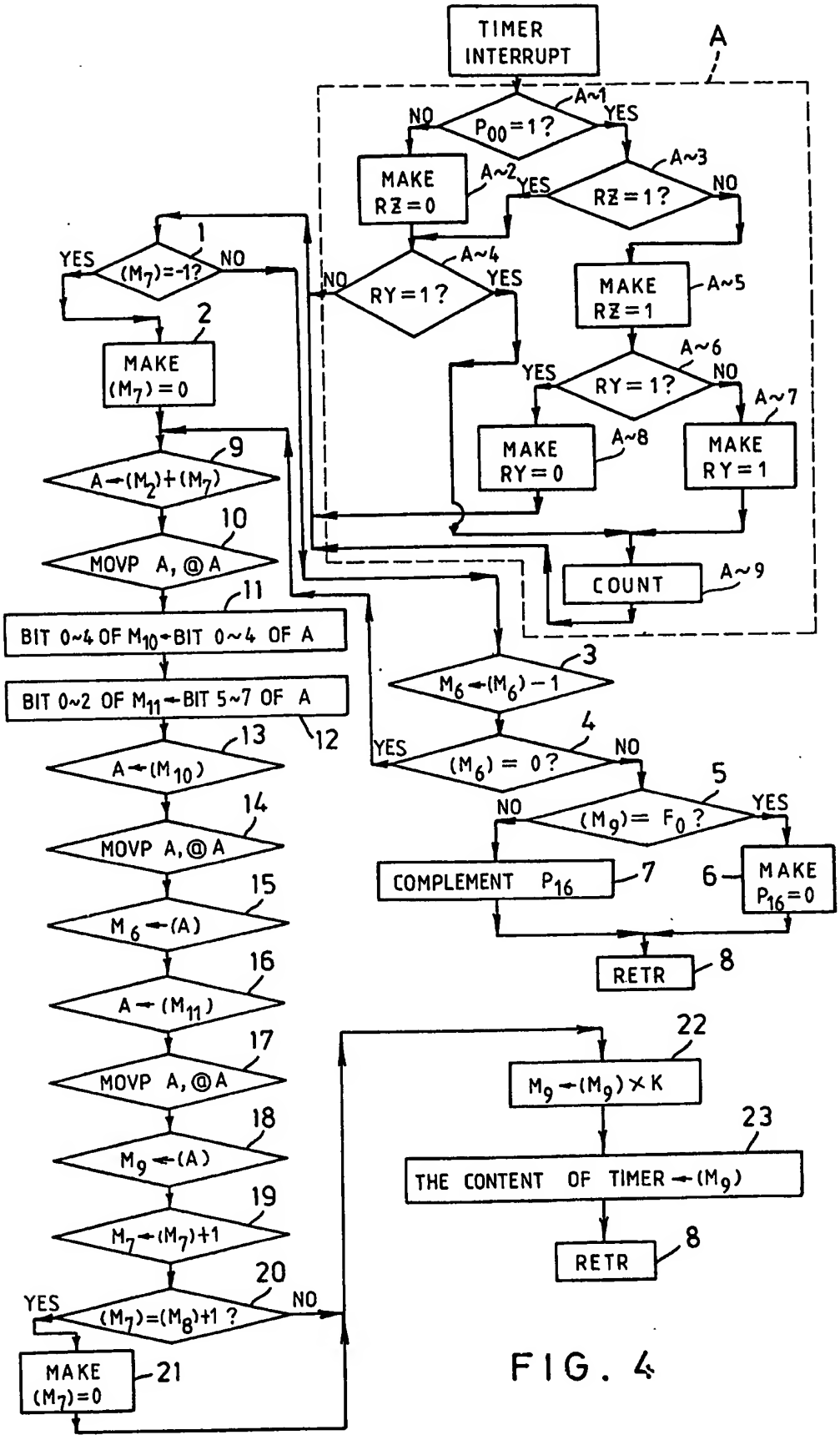

FIG. 4

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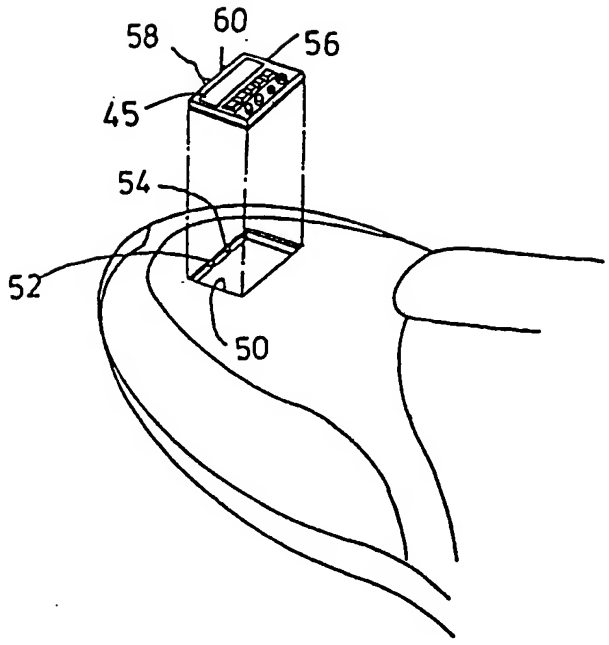

FIG. 5

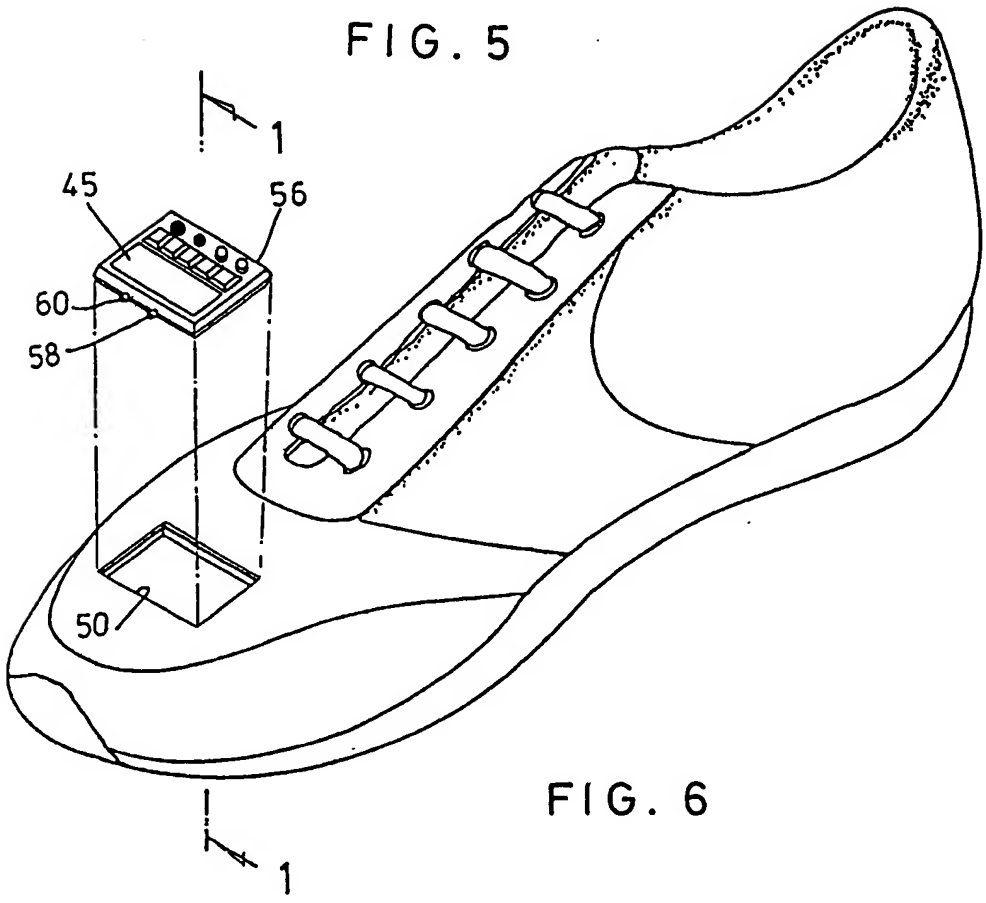

FIG. 6

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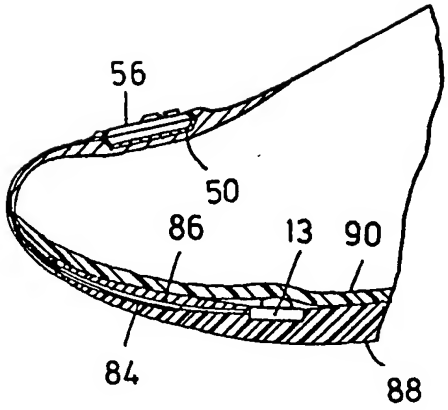

FIG. 7

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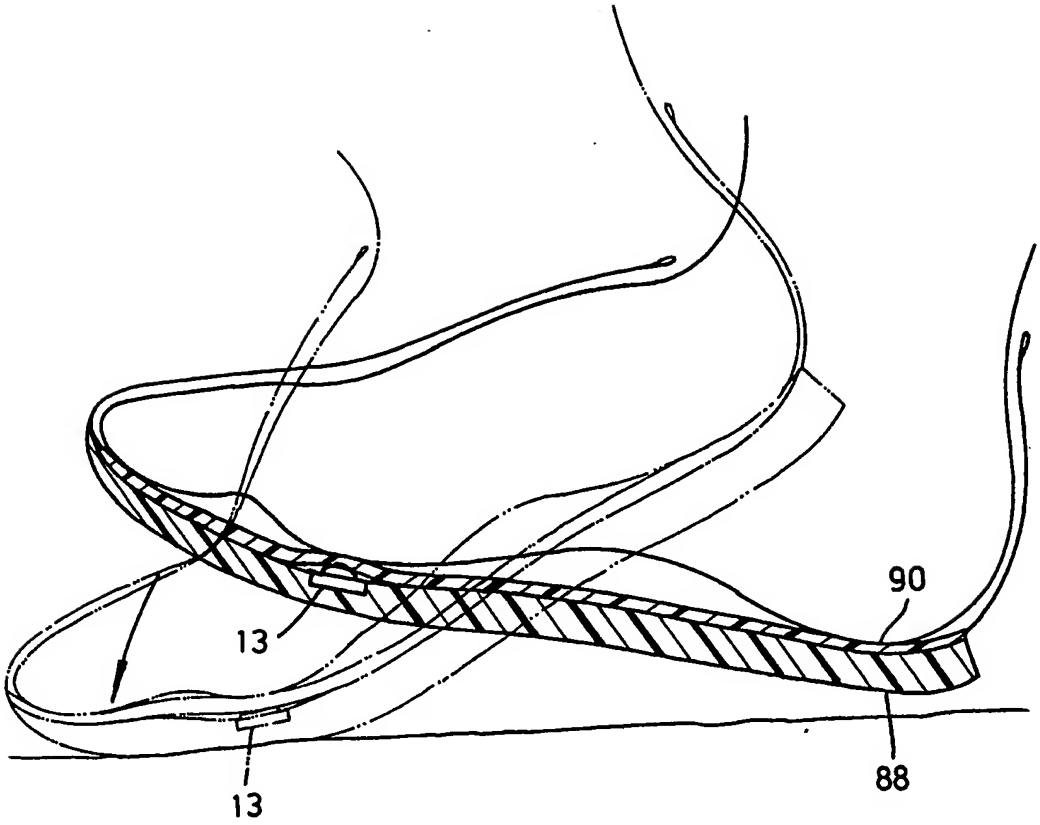

FIG. 8

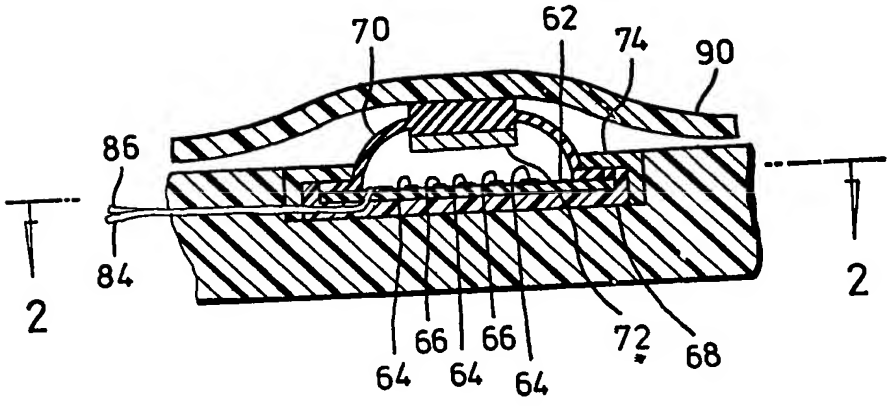

FIG. 9

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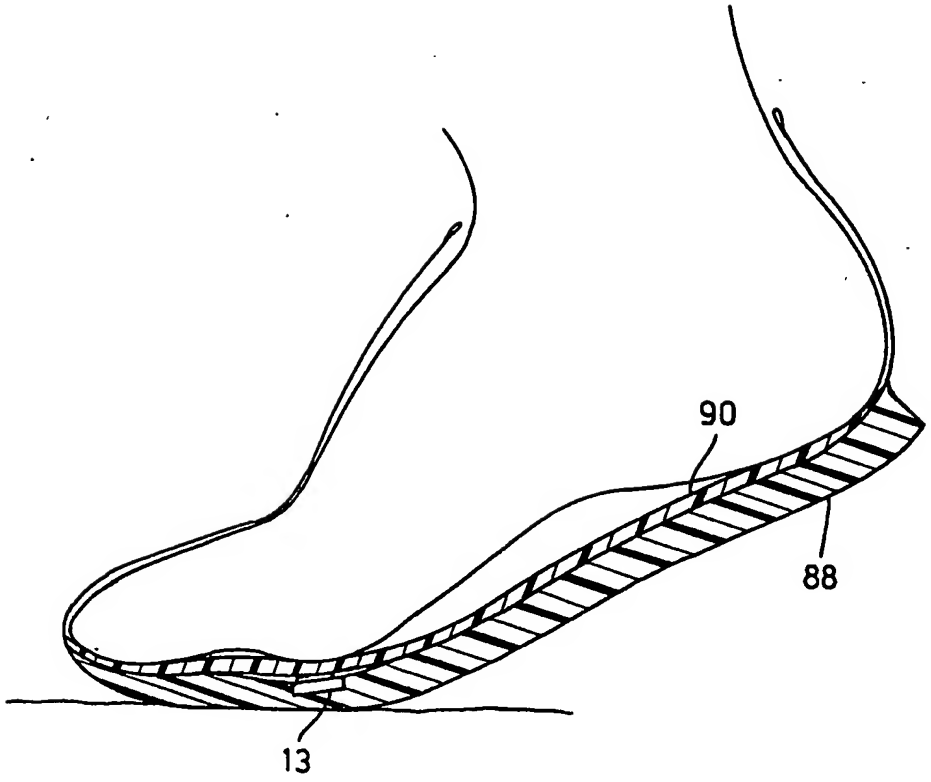

FIG. 10

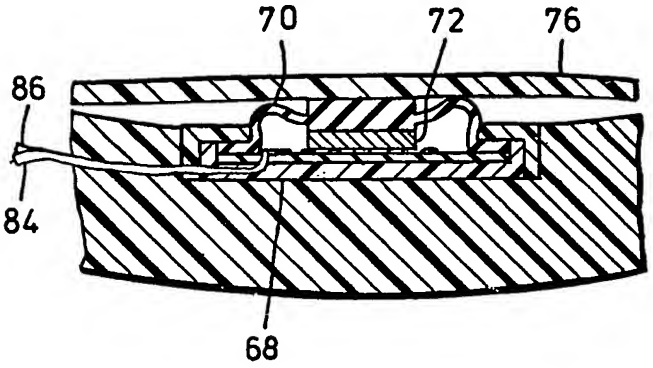

FIG. 11

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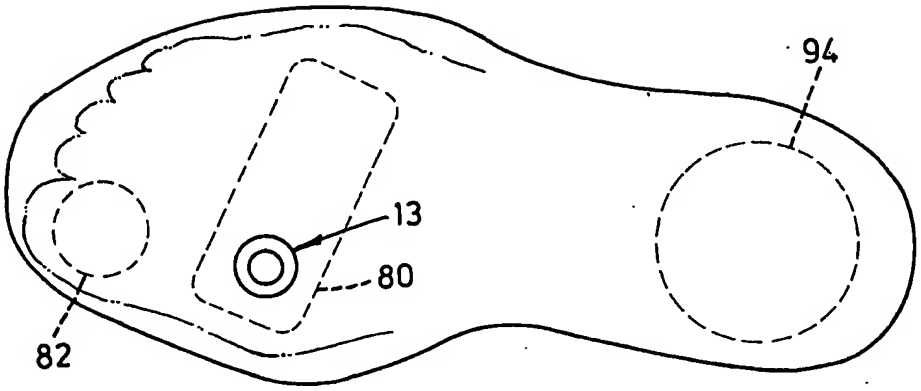

FIG. 12

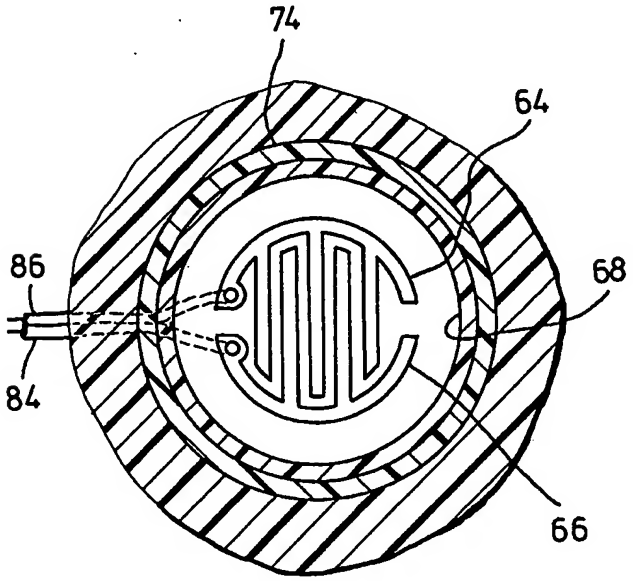

FIG. 13

SPECIFICATION

Electronic music pace and distance counting shoe

The present invention relates to a device for counting the number of steps and measuring the distance people have walked or run.

Many pedometers recorded in prior arts have been developed to mechanize the counting of steps. Such pedometers, as they are commonly known, generally rely on a counting mechanism attached to the shank or the heel, or formed in the heel or the toe portion of the shoes. No other device of the prior art can provide functions other than the counting of steps.

It is, therefore, an object of the present invention to provide a device by athlete or ordinary people such as walker, jogger, or runner to counting their steps.

It is the another object of the present invention to provide a device which can measure the total distance people have stridden. The other objects of the present invention will be pointed out herein below.

The present invention provides an additional electronic circuit device in a shoe which, upon walking, jogging or running, applies the technique of utilizing a single chip microcomputer. An external walking sensor circuit generates square wave signals to an I/O circuit in the microcomputer chip. A software control program will count the square wave signals entered to get the pace number. Several microcomputer I/O circuits are used to drive a multisegment digital displayer (generally, it has 7 segments) and another several I/O circuits are used to execute a scan of each digit, so the pace number to be counted can be displayed.

In accordance with another aspect of the present invention, a microcomputer can be preset with a normal length of stride of a walker, runner or jogger and then display the approximate total distance on its display after multiply by the number of strides.

In accordance with another aspect of the present invention to provide a timing recorder, a DTMF generator held by the user or others generates a particular DTMF (Dialing Tone of Multiple Frequency); and a decoding device, upon receipt of above particular DTMF, will decode it as "High" and supply it to the microcomputer to decide whether the "High" sign is the odd or even signal after starting and then to start or stop the counting of time.

In accordance with another aspect of the present invention, the microcomputer chip contains a timing program which according to the data supplied by the decode device can measure the time required for the "High" signal from the odd High signal to the even High signal and then calculate the exact time required for a runner or walker from one place to another.

In accordance with another aspect of the present invention the microcomputer chip contains a control program which can preset a count and automatically decrease the count by one in response to each pace. An audible alarm is sounded when the preset count is decreased to zero.

In accordance with another aspect of the present invention, the microcomputer chip contains control programs which are used to generate many different musical notation signals which are applied, through an amplifying circuit to a speaker, so that music can be generated simultaneously when walking to entertain the walker.

In accordance with another aspect of the present invention, software control programs are provided to generate many sounds with different beats (such as drumbeats) and to convert the musical notation signals into the beat sound signals when the walking speed reaches a certain degree. One or more than one multistage turning switches are used to select and determine the music or beat varieties required for walking.

In accordance with another aspect of the present invention a software control program is used to count the time interval from a walking input signal to the next walking input signal; and another control program utilizes the time interval counted as above mentioned to determine the tempo for the given music beat or beat sound. The tempo for the music beat or beat sound can thus be adjusted to the walking speed rate.

In accordance with another aspect of the present invention, a radio transmitter is used to put the musical notation signals or beat sound signals into a carrier for modulation so as to transmit them in the air, then they will be received by a receiver which is disposed on the wearer or elsewhere.

In accordance with still another aspect of the present invention, one or more than one of multistage selecting switches are used to select the pace number, distance time or walking speed rate required for displaying.

A software control program is also provided to obtain the walking speed rate (pace number per hour or per minute) by applying the time interval counted from a walking input signal to the next input signal as above mentioned.

A keyboard is provided at the vamp or other adequate places which allow the wearer to operate and communicate with the CPU of the microcomputer chip.

An embodiment of the invention will now be described, by way of example, with reference to accompanying drawing, in which:

Figure 1 is a schematic diagram of exemplary hardware in accordance with the present invention.

Figure 2 is a schematic diagram of another example of the walking sensor of Figure 1.

Figure 3 is a block schematic diagram showing the main flowchart in accordance with the present invention.

Figure 4 is a block schematic diagram showing the subflowchart in accordance with the present invention.

Figure 5 is a perspective rear view of a shoe showing the contacts and the housing in accordance with the present invention.

Figure 6 is a perspective rear view of said shoe.

Figure 7 is a cross sectional view taken along lines 1—1 of Figure, showing the switch and the housing.

Figure 8 is a diagram showing the position where the switch and the condition that the shoe is going to step on the ground.

Figure 9 is a broken sectional view showing the separate condition of contact and the contacts.

Figure 10 is a diagram showing that the user's shoe steps on the ground and that the joints of his big toe are compressing switch.

Figure 11 is a broken sectional view showing contact connecting simultaneously with contacts.

Figure 12 is a plan view showing the position where the switch is placed.

Figure 13 is a sectional view taken along lines 2—2 of Figure 9, showing the layout of the contacts on the insulating board.

Referring now to Figure 1, identified by reference numeral 10 is an electronic circuit device of the present invention. Said electronic circuit device 10 including a suitable microcomputer 11, such as an INTEL 8021; a walking sensor circuit 12 communicating to the test pin T_1 of the microcomputer 11, comprising a sensing switch 13 and a debounce circuit 14 means for generating a pace signal to said microcomputer 11 in response to each pace while the walker or runner makes press sensing switch 13; a decording device 23 communicating to the I/O port P_{1a} of the microcomputer 11, for providing a High signal to said microcomputer 11 in response to each Dialing Tone of Multiple Frequence (DTMF) sound signal which generated by DTMF generator (92) held by said walker, runner or another. By mean of the above High signal. An odd High for the said microcomputer 11 decides the start or stop of timing; a display device 29 provides an indication of the accumulated total of incremental counts to the user for indication of incremental counts to the user for indication of the pace number, distance, time or walking speed rate covered during walking jogging, running, etc. which is computered by the microcomputer 11, and provided through microcomputer outputs P_{04}—P_{07} and P_{10}—P_{15}; an output device 30 is coupled to microcomputer output P_{16}, means for provided the sound beats or music upon walking or alarm sound upon completing the preset pace number which is generated by a speaker of said output device 30, or providing said output signals corresponding to said sound beats or music or alarm signal which is transmitted by a transmitter of said output device 30; the tristage selecting switch 36 is coupled through microcomputer inputs P_{20}—P_{22} to the microcomputer 11, means for selecting the music or beat varieties; the quadstage selecting switch 37 is coupled through microcomputer inputs P_{02}, P_{03} and P_{23} to the microcomputer 11, means for providing to control display of the pace number, distance or walking speed rate; the first storing switch 38 is coupled through microcomputer input P_{17}, also provided effect storage of the data of the preset pace number displayed on said display device 29 in a pre-partitioned memory; the second storing switch 39 is coupled through microcomputer input P_{01}, also provided effect storage of the data of the stride length displayed on said display device 29 in a pre-partitioned memory; and a reset switch 40 is coupled to the reset pin of the microcomputer 11.

To preset a pace number count, a switch 21 is pressed to apply square waves, generated by an oscillator 22 to Test input T_1 of microcomputer 11. At this time, display 45 will display the number of square waves applied to T_1. When the digit shown on reaches the number desired, switch 21 is released. Switch 38, is then depressed to enter the displayed number into the prepartitioned memory.

To preset the stride length, a switch 21 is pressed to apply square waves, generated by an oscillator 22 to Test input T_1 of microcomputer 11. At this time, display 45 will display the number of square waves applied to T_1. When the digit shown on reaches the number desired, switch 21 is released. Switch 39, is then depressed to enter the displayed number into the prepartitioned memory.

A detailed diagram of circuitry of the device is illustrated.

Microcomputer 11 includes a 1 k location Read Only Memory (ROM);

A 64 byte Random Access Memory (RAM) each byte denoted by R_0, R_1, . . . R_{63} respectively;

An 8 bit timer;

Two 8-bit I/O ports P_0 (P_{00}—P_{07}) and P_1(P_{1a}—P_{17}), and a 4 bit I/O port P_2(P_{20}—P_{23}), 20 I/O circuits in total; and a test pin T_1 which can be used for input purposes.

The 1k ROM is divided into 4 pages, and can jump only to within the same page upon a conditional jump.

The 64 byte RAM two eight-register bands.

Walking sensor circuit 12 (shown in dotted line) includes a sensing switch 13 located in the sole of shoe as will be explained. Switch 13 will be momentarily depressed (on), one time each time a pace is made. Once switch 13 is on, a positive going pulse is generated and applied through a shaping circuit 15, to excite a transistor 16, the pulse is applied to a phase inverter 17 which generates an instantaneous positive potential. An operational amplifier 18 (OP AMP) will elevate the current potential power and make it pass through a filter circuit 19 composed of capacitive reactances to patch the capillary space. As a result, the pulses are provided to T_1 through a SCHMIDT trigger 20. Thus, the signals obtained by T_1 (High when there is no signal, and low where there are signals) will be very stable.

Figure 2 shows another illustration of walking sensor circuit of Figure 1 using a switch 13' put in the sole. Comprising a magnet 41, cooperating with a coil NS, wound about a magnetic

permeable core. Each pace the walker makes will press 13' to drive the magnet 41 past a portion of coil causing NS a small voltage to be generated at point E. The small voltage is amplified and shaped, generates a Low signal at the output terminal for application to microcomputer input T_1. If desired, a photo-optical switch can be used for switch 13.

Said decoding device 23 including a microphone 24, for converting a particular DTMF sound into an electronic signal while received from DTMF sound generator which is help by the walker, runner, jogger or another. The output of microphone 24 is provided to an amplifier 25 for amplifying said an electronic signal of the output of said microphone 25. The output of amplifier 25 is provided to a DTMF tone decoder 26 for decoding said electronic signal into the signal of corresponding Binary Code of Decimal (BCD). Supposed the microphone 24 receives a particular DTMF sound with Row of 852 Hz, and Column of 1477 Hz, then the corresponding BCD signal is "1001" in other word, the signals of the leads 42 of the DTMF tone decoder 26 is "1001". The output of the DTMF tone decoder 26 is provided through the leads 42 & 42' to an AND gate 27, since the 2 leads between 27 and 26 serialize a phase inverter 43 & 44. Thus, the result output of the leads 42' is "1111" and provided to the AND gate 27. Therefore the output of the and gate 27 is High and provided to the microcomputer input P_{00}, then the microcomputer enters timing state. But, the microcomputer 11 stopped to timing while the microphone 24 receive again. The above timing function will be described later.

For timing purpose, the walker, runner, jogger or another holds a DTMF generator to generate a particular DTMF, starts the generator and start timing while beginning walking or running and stop the generator and timing while stopping walking or running, then the time covered during walking, jogging, running and etc. can be exactly measured.

Display device 29 includes a BCD to seven segment converter 28 is provided by microcomputer outputs P_{04}—P_{07}; and a display 45 (generally, it has 7 segments) includes 6 digits in this illustration. The data for 7-segments and point is provided by outputs 46, and the scanning data for the digit to be lighted is provided by microcomputer outputs P_{10}—P_{15}.

An amplifier 31 of the output device 30, connected to a speaker 32, and a radio transmitter 33, in turn, coupled to an Antenna 34. A coupling switch 35 is provided to selectively feed the sound signals generated by amplifier 31 directly into speaker 32 and transmit them in a radio way. When the allocation is as shown in the figure (i.e. S_1 is On, S_2 is Off), the signals are fed in speaker 32 and sounded directly. When, however, S_1 is Off and S_2 is On the signals the transmitted by radio transmitter 33.

The second stristage selecting switch 37 means for providing to control display of various data, when the switch 37 is at the location "0", the signal of the pace number will be fed into display device 29. If 37 is at location "1", the signal of the walking speed rate will be fed into said display device 29. If 37 is at location "2", the signal of the total distance will be fed into said display device 29. If 37 is at location "3", the signal of the time will be fed into said display device 29.

Flowcharts of the software programs of the present invention, are shown in Figures 3 and 4, Figure 3 shows the main flowchart and Figure 4 is a flowchart of interrupt service routine when the Timer causes interrupt. Firstly, some memories and various tables established in microcomputer 11 will be described as follows:

Memory N, composed of more than two registers, is used to record the time interval data between successive High signal outputs from the walking sensor circuit 12.

Memory M_0, composed of more than two registers, is used to prestore the data representing a desired number of stride length.

Memory M_1, composed of more than two registers, stores the time interval data being accumulated in N when HIGH signals coming from the walking sensor go low; that is, it stores the time interval data indicative of the period that the square wave pulse (square wave in Low form) coming from the walking sensor ends and the next square wave pulse appears.

Memory M_2 is a register, which is used to store the starting address of a designated music table or a designated sound table.

Memory M_3, composed of more than two registers, is used to store the resultant count data after counting the number of square waves provided by the walking sensor.

Memory M_4, composed of more than two registers, is used to prestore the data representing a desired number of paces.

Memory M_5 is a register, which is used to store starting data about the time it starts its time-counting. The object of this function is that the time interval between the interrupt of the timer to its next interrupt can be freely controlled through M_3.

Memory M_6, composed of more than two registers, is musical score and meter memory and used to store the data about how many square waves shall be provided from output terminal P_{16}.

Memory M_7 is a register, which is used to store the address of the data of a designated musical or sound frequency after checking them in the music or sound tables.

Memory M_8 is a register, which is used to store the data number contained in a designated music or sound table after checking them.

The music or sound table, comprises a plurality of successive 8-bit bytes containing the data of musical score or sound frequency. Each word in the music table is organized as follows: BIT 0 2 designate musical notation (i.e. 1, 2, . . . 7 and rest), BIT 3, 4 designate scale (i.e. bass, alto, treble and etc.), BIT 5 7 designate meter

(semiquaver, quaver, crotchet, minim, simple time, double time, triple time and quadruple time). Three music tables (tables of three different songs) and three sound tables (tables of three different beat sounds) are provided. A musical notation table (incl. bass, alto and treble) and a musical meter table are further needed, all of which are listed below:

The musical notation table contains the frequency data for the respective music notations. An exemplary table is as follows (starting address is denoted by MT):

MT:	X X X 0 0 0 0 0	(rest) → F_0
	X X X 0 0 0 0 1	(1) → LF_1
	X X X 0 0 0 1 0	(2) → LF_2
	X X X 0 0 0 1 1	(3) → LF_3
	X X X 0 0 1 0 0	(4) → LF_4
	X X X 0 0 1 0 1	(5) → LF_5
	X X X 0 0 1 1 0	(6) → LF_6
	X X X 0 0 1 1 1	(7) → LF_7
	X X X 0 1 0 0 0	(rest) → LF_0
	X X X 0 1 0 0 1	(1) → F_1
	X X X 0 1 0 1 0	(2) → F_2
	X X X 0 1 0 1 1	(3) → F_3
	X X X 0 1 1 0 0	(4) → F_4
	X X X 0 1 1 0 1	(5) → F_5
	X X X 0 1 1 1 0	(6) → F_6
	X X X 0 1 1 1 1	(7) → F_7
	X X X 1 0 0 0 0	(rest) → F_0
	X X X 1 0 0 0 1	(1) → HF_1
	X X X 1 0 0 1 0	(2) → HF_2
	X X X 1 0 0 1 1	(3) → HF_3
	X X X 1 0 1 0 0	(4) → HF_4
	X X X 1 0 1 0 1	(5) → HF_5
	X X X 1 0 1 1 0	(6) → HF_6
	X X X 1 0 1 1 1	(7) → HF_7

Scale Notation

The data as above listed is the frequency data of musical notation (LFi is Low frequency, FI is medium frequency and HFi is High frequency), this data will be loaded into the timer to determine how much time is needed for each interrupt the timer causes, and then, the frequency of sound wave coming from P_{16} can be selected and determined to form a desired musical notation.

An exemplary musical meter table, (starting address is denoted by NT) is as follows:

NT:	X X X X X 0 0 0	(1/16 beat) → P_0
	X X X X X 0 0 1	(1/8 beat) → P_1
	X X X X X 0 1 0	(1/4 beat) → P_2
	X X X X X 0 1 1	(1/2 beat) → P_3
	X X X X X 1 0 0	(1 beat) → P_4
	X X X X X 1 0 1	(2 beat) → P_5
	X X X X X 1 1 0	(3 beat) → P_6
	X X X X X 1 1 1	(4 beat) → P_7

The data as above checked is the musical square wave number coming from P_{16}, as this number certainly exceeds 255, it must be stored with two bytes.

A memory M_9 is utilized to store the frequency data obtained immediately after checking the musical notation table and use Memory M_6 to store the data about the number of square waves which is obtained immediately after checking the musical meter table (as above mentioned), M_6 is composed of more than two registers).

A register M_{10} is utilized for registered the address data of musical notation table (incl the portion of musical scale).

A register RX acts as a mark (FLAG) to record whether walking signals from the sensor have been read-in, (1 for Yes, 0 for No).

Register RY is use to check whether Port P_{00} is the first, third or any odd High input. If yes, it is 1, otherwise 0.

Referring now to Figure 3, the main routine will be described.

At program block 1 the signals provided by the walking sensor are read, if there exist signals, enter into block 2, or enter into 6.

At program block 2 it is determined whether the signals of the walking sensor to be read have been processed. At block 3 the data of memory N is loaded into M_1 (as above mentioned, N is a memory which contains a count indicative of the time interval that the walking sensor has no signal); at block 4, after loading memory M_{11} register N is cleared to 0 and RX is set at 1 to avoid repeated processing of same signals coming from the walking sensor. As indicated at block 5, the number of LOW square waves provided by the walking sensor are then counted.

As shown at Blocks 6 and 7 during the period the walking sensor has no signal, (T=1) RX is cleared to 0 so that processing the signals possibly generated next time can be effected. Further, the time interval during this period is counted. However, when the content of N is counted to more than a certain value Z (that is, when the wearer takes off the shoes or the walker stops walking), they will not count any more.

As shown at blocks 8 and 9, if switch 38 (store display) is on, content of M_3 is loaded into M_4. If switch 38 is not on, as shown at block 8-1 and 9-1, if switch 39 is on, content of M_0 is loaded into M_4. If switch 39 is not on, as shown at blocks 24 28 the pace number is compared to the preset pace number (M_4). If the pace number is equal to the preset number a reminding call (alarm) signal will be generated from P_{16}. If the pace and preset number are not equal, (or switch 38 is on), as shown at blocks 10 12 the state of selecting switch 37 is tested. As shown at blocks 10 12, when the switch 37 is at the location "0", the display device will display the pace number walked or runned (as shown at "display 1"), If at the location "1", it will display the walking speed rate (i.e. the pace number per unit time, as show at "display 2"); and at the location "2", it displays the total distance walked or run (as shown at "display 3"); if at location "3", it will display the time walked or run (as shown at "display 4").

As shown at block 13 the count indicative of the time interval during the period the walkIng

sensor has no signal, is compared to a preset standard value Y: if more than Y (that is, the walking speed rate is less then a certain value), the location of multistage selecting switch 36 (Figure 1) is and select the required music table or beat sound table is selected in accordance with blocks 19 23; if less than or equivalent to Y, in accordance with blocks 14 18.

X_1, X_2 and X_3 each denotes a starting address of three different music tables, and R_1, R_2 and R_3 each denotes a data number contained in these three tables Y_1, Y_2 and Y_3 each denotes a starting address of three different beat sound tables, and S_1, S_2 and S_3 each denotes a data number contained in these three tables. When the walking rate is less than a certain value, subject to the location of multistage selecting switch, starting address of a certain music table is loaded into M_2 and store its contained data number loaded into M_8 (as shown in blocks 21 23). However, when the walking rate is more than a certain value, the starting address of a designated beat sound table and its contained data number will be stored (as shown in blocks 16 18).

After the appropriate data has been loaded in to M_2 and M_8, as represented at block 29, the content of N is used to obtain a K value, (this K value is the factor determining the tempo of music or beat sound) and the content of N is used to obtain the walking speed rate per unit time of all kinds. Thereafter, as shown at blocks 30 32, if use of the shoes stop, the timer interrupt is described to eliminate the music or beat sound. Further, as shown at block 31 when the content of N is more than Z because the shoes walking have not yet begun, the timer will cause the first interrupt and re-operate from the starting point in accordance with the mark "$(M_7)=1$". However, block 33, the timer causes an interrupt and the music or beat sound when the content of N is less than Z (that is, walking has begun).

As shown in Figure 4, referring to "TIMER INTERRUPT SERVICE ROUTINE", the incurrence of interrupt is applied to alternately make P_{16} become 1 or 0. Also, the time and the number of times set for causing interrupt is applied to control the output frequency P_{16} and to provide a music effect.

Or Apating this routine to counting time in training of a runner or jogger. The block A dotted is to decide counting time first then pace counting. And the other operation of the same routine is done after each time unit as shown in block A-3, a register Rz is used to read the data on P_{00} of A-1. When P_{00} is read as 1, we have to decide if such 1 is the one read on P_{00} last time. If positive, 1 is set; otherwise, 0 is set.

Block A-1 is for reading data from P_{00}. If "0" is read from the date of P_{00}, Rz is set as 0 to wait "1" appearing from P_{00} and record the 1 as the first starting. After that, Ry is checked. If Ry is 1, then we consider odd number of 1 has appeared on P_{00} and it must be 1 at this moment. The counting time work will start in block A-9.

If P_{00} is 1, and Rz is too at this moment, the 1 of P_{00} is decided as the same 1 read last time. Then Ry will be passed and data enters directly into A-4 to decide if starting the time counting.

The function of Blocks A-5, A-8 is to work alternatively on Ry to be 1 or 0, so as to register whether the 1 on P_{00} is the odd time or even time and then to decide if starting the time counting or not.

The above is to decide whether timing or not. If it is to start timing, and the timing is performed, a program will enter into the position beyond the dotted line to proceed treatment by the electronic music.

If it is adopted in timing of the running training we can just stop the function of the electronic music and add a I/O line as a decision line.

As shown in block 1 it is first determined whether to work from the starting point, $((M_7)=-1)$ and, if so, to initialize (block 2) set $(M_7)=0$ (i.e. the starting point). If the content of M_7 is not initialized, the pulse count in M_6 is decremented, and checked for completion (block 3 and 4). If the pulse count in M_6 has not been completed, (or after M_7 is initialized), as shown in block 9, the starting address of a designated music table and the content (that is the address of a certain notation data in the music table) of (M_7) are summed and the aggregate loaded into A (Accumulator). As shown in block 10 the content of the address memory designated in A and stored is then loaded into A. Therefore, the data in A will be a designated notation data at this time The respective fields of musical notation data (incl scale portion) and musical meter portion, are separated, and temporarily stored into M_{10} and M_{11}, respectively.

As shown in blocks 13 18 the musical notation table and musical meter table are then checked and the checked result loaded into M_8 and M_9 respectively.

As shown in block 19 content of M_7 is then incremented, so that the next location in the music table or beat sound table can be obtained when making a sequential table check. As shown in block 20, the content of M_7 is then checked against the data number contained in table, if more than the data number, re-clear it to become 0. Thus, the music or beat sound signals can be repeatedly and circulatively generated.

As indicated block 22 the content of M_9 is multiplied by the value K (block 29 as shown in Figure 3) to adjust the time interval of the interrupts. Thus, the walking speed can control the tempo of music or beat sound.

As indicated at block 23 the content of M_9 is then moved into the timer.

The number of of square waves generated by P_{16} is again decremented and checked for completion. If the count has been completed, it is determined whether the musical notation is a rest. If it is, make $P_{16}=0$ (as block 6 shows), if not, alternately make $P_{16}=0$ or 1 (as block 7 shows).

The work content of block 8 is: when service is

over, the program reset to the address of main program.

As shown in Figure 7, switch 13 is formed in the sole 42, which is covered by foot pad 90, the two insulated wires 84 and 86 from said switch 13 are connected at their ends with the contacts 52 and 54 formed in case 50 (as shown in Figure 5).

As shown in Figure 6, the electronic device is arranged in housing and extrudes contacts 58 and 60; when housing 56 is inserted in case 50, said contacts 58 and 60 contact contacts 52 and 54 respectively; in cleaning the shoe, replacing the cell, or device 10 is damaged, the housing 56 can be removed.

As shown in Figure 9, the switch 13 includes an insulating board 62, which disposed two contacts 64 and 66, and communicates through insulated wires 84 and 86 to the housing 56. Said insulating board 62 is fixed on the casing 68. Thereon, an insulating rubber 70 is disposed, having elasticity. (The insulating rubber 70 is often used in commercial keyboard). A contact 72 is fixed under the insulating rubber 70. The circumstance of said insulating rubber 70 and case 68 are covered by cover 74. And, a foot pad 90 covers over said insulating rubber 70 and rises up a little.

As shown in Figure 12, said switch 13 is placed under the joints of the big toe of the user, and can also be placed on the area 80 under the joints of another toe for the user, or on the area 82 under the big toe of the user; or on the area 94 under the heel of the user; but the place under the joint of the big toe is preferred.

As shown in Figures, 10 & 11, when walking, the foot pad 90 is compressed to make the contact 72 and the contacts 64 and 66 touch and define an ON condition. As shown in Figure 8 and 9, when lifting the show, the elasticity of the insulating rubber 70 removes the contact 72 from the contacts 64 and 66 to provide an OFF condition.

As shown in Figure 13, the contacts 64 and 66 are disposed on the insulating board 70, they inserted but do not connect, to one another in order to provide more opportunity of touch to contact 72; when the foot pad 90 is compressed the switch can precisely define ON condition.

Claims

1. Apparatus adapted for disposition on a shoe, comprising: a switching device for generating a pace signal in response to each pace by said shoe, an electronic device responsive to said pace signals for generating a pace count indicative of paces taken with said shoe, said electronic device comprising: means for storing indicia of a predetermined number of paces; means for comparing said pace count to said stored number of paces, and generating alarm signals in accordance with said comparison; means for storing indicia of a predetermined stride length; means for multiplying said paces by said predetermined stride length; for providing total distance; means for counting the time; and a display device for providing indicia of said counts.

2. The apparatus of claim 1 wherein said electronic device further comprises, means responsive to said pace signals, for generating an interval count indicative of the time interval between successive pace signals; means responsive to said interval count, for generating a rate signal indicative of the repetition rate of said paces; and means for selectively applying said pace count and said rate signal to said display device for display.

3. The apparatus of claim 1 or 2 wherein said alarm signals comprise a representation of music.

4. The apparatus of claim 1 or 2 wherein said alarm signals comprise a representation of a beat sound.

5. The apparatus of claim 1 wherein said device further includes radio transmitter means for transmitting said alarm signals.

6. The apparatus of claim 3 wherein said device further includes radio transmitter means for transmitting said alarm signals.

7. The apparatus of claim 4 wherein said device further includes radio transmitter means for transmitting said alarm signals.

8. The apparatus of claim 1 wherein said electronic device further including: means responsive to each dial tone of multiple frequency signal, for generating a control signal for starting or stopping the counting of said time.

9. The apparatus of claim 1 further including data entry means, disposed on said shoe, for selectively providing data input signals to said electronic device.

10. The apparatus of claim 9 wherein said data entry means includes a keyboard.

11. The apparatus of claim 2 further including data entry means, disposed on said shoe, for selectively providing data input signals to said electronic device.

12. The apparatus of claim 1, 2, 8, 9 or 10 wherein said electronic device comprises: a microprocessor, including a first input port receptive of said pace signals; a first group of output ports, for communicating data to said display device; a second group of output ports for generating control signals to said display device, to effect scanning operation of said display device; a second input port, receptive of data input signal; a second group of input ports, receptive of data input signals; and a third output port for generating said alarm signals.

13. The apparatus of claim 12: wherein said alarm signals comprise a representation of music.

14. The apparatus of claim 12 wherein said alarm signals comprise a representation of a beat sound.

15. The apparatus of claim 12 wherein said device further includes radio transmitter means for transmitting said alarm signals.

16. The apparatus of claim 1, 2, 9 or 10, wherein said device is constructed as an integral part of said shoe.

17. The apparatus of claim 1 wherein said means for storing comprises: an accessible memory; and data input means for selectively generating signals indicative of said predetermined numbers to establish a count in said memory.

18. Apparatus adapted for disposition on a shoe, comprising: means for generating a pace signal in response to each pace taken with said shoe; an electronic device responsive to said pace signals, said electronic device including: first memory means comprising at least one group of addressable locations for storing indicia of respective sounds; output means, selectively receptive of signals from said first memory means, for controllably generating audible representations of said sounds; and means, responsive to said pace signals, for selectively designating respective locations of said first memory means in predetermined sequence and sequentially applying signals indicative of the contents of each of said designed location to said output means.

19. The apparatus of claim 18 further comprising: second memory means for storing indicia of the number of paces taken; third memory means, responsive to data input signals applied thereto, for storing indicia of a predetermined count; means for comparing said number of paces taken and said predetermined count, and generating a comparison signal in accordance with said comparison; and alarm means, responsive to said comparison signal, for selectively effecting generation of alarm indicia.

20. The apparatus of claim 19 wherein said alarm means comprises means for selectively actuating said means for designating.

21. The apparatus of claim 18 or 19 further comprising: fourth memory means for storing indicia of a predetermined stride length; means for multiplying said number of paces of said second memory means by said predetermined stride length, and providing a product in accordance with said multiplying; and fifth memory means for storing indicia of said product.

22. The apparatus of claim 18 further comprising: means for generating a control signal in response to each Dial tone of multiple frequency signal; sixth memory means for storing indicia of the starting or stopping of timing in accordance with said control signal; and means for counting the time from the starting of to the stopping. Seventh memory means for storing indicia of said time.

23. The apparatus of claim 18 further comprising: display means, responsive to output data signals applied thereto, for generating visual indicia of said output data; means for selectively applying signals from said second memory means representative of said number of paces, as output data signals to said display means; means for selectively applying signals from said fifth memory means representative of said product, as output data signals to said display means; and means for selectively applying signals from said seventh memory means representative of said time, as output data signals to said display means.

24. The apparatus of claim 18, 19 or 21 further comprising: eighth memory means for storing an interval count indicative of the time interval between successive pace signals; means, responsive to said interval count, for generating rate signals indicative of the repetition rate of said paces; and means, for selectively applying said rate signals as output data signals to said display means.

25. The apparatus of claim 18 wherein said means for selectively designating includes: ninth memory means responsive to selection data signals applied thereto for storing indicia of the starting address of a designated portion of said second memory means; means, for storing indicia of an instantaneous address, corresponding to said starting address incremented in response to each said pace signal; and means for applying signals to said output means in accordance with the content of the location in said first memory means corresponding to said instantaneous address.

26. The apparatus of claim 25 further including data entry means for selectively generating said selection data signals to designate different portions of said ninth memory means.

27. The apparatus of claim 18 wherein said first memory means comprises: a music notation table, comprising a plurality of addressable memory location, each corresponding to a respective predetermined frequency; a meter table, comprising a plurality of addressable memory locations, each corresponding to a respective musical beat; and a score table, including at least one group of addressable memory locations, each location in said group corresponding to a portion of a musical score and containing indicia of a location in said music notation table and a location in said meter table.

28. The apparatus of claim 18, 19, 21, 22, 23, 24, 25 or 27 wherein said apparatus is constructed as an integral part of said shoe.

29. Apparatus adapted for disposition on a shoe, comprising: a sensor switch for generating a pace signal in response to each pace by said shoe, and an electronic device responsive to said pace signals for generating a pace count indicative of paces taken with said shoe.

30. The apparatus of claim 29 wherein said sensor switch is disposed on the upper portion of the sole of said shoe.

31. The apparatus of claim 30 wherein said shoe further including a foot pad for covering a said sensor switch.

32. The apparatus of claim 29 wherein said sensor switch further dispose in the sole of said shoe.

33. The apparatus of claim 29 wherein said sensor switch is placed under the joints of toes of the user.

34. The apparatus of claim 29 wherein said

sensor switch further place under the big toe of the user.

35. The apparatus of claim 29 wherein said sensor switch further place under the heel of the user.

36. The apparatus of claim 29 wherein said electronic device is fixed on said shoe.

37. The apparatus of claim 29 wherein said electronic device includes: means for tentative fixing and for tentative separation from the said shoes.

38. An apparatus comprising: a generator for generating a dial tone of multiple frequency signal; and an electronic device responsive to said dial tone of multiple frequency signal for generating a period of time count, said electronic device comprising: a decoding device for decoding said dial tone of multiple frequency signal into a control signal; means for starting or stopping of timing in accordance with said control signal; a counter for counting the time from the starting of timing to the stopping; and a display device for providing indicia of said count.

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